REMARKS

In the Office Action, the Examiner objects to Claims 9, 29, and 30 under 37 C.F.R. § 1.75(c) as being of improper dependent form for failing to further limit the subject matter of a previous claim. The Examiner notes that the claimed bonding pad or separate surface does not further limit the wire bonding device. The Applicant thanks the Examiner for noting this discrepancy and hereby cancels Claims 9, 29, and 30.

The Examiner also rejects Claims 4, 6-11, 21, 23, and 27-39 on the grounds of nonstatutory obviousness-type double-patenting as being unpatentable over Claims 1, 2, 5, and 7-9 of U.S. Patent No. 5,979,737 in view of Zimmerman, U.S. Patent No. 4,786,860.

The Examiner indicates that although the conflicting claims are not identical, they are not patentably distinct from each other because both teach a wire bonder ('737 bonding head) comprising a bonding head, wire clamp ('737 Claim 8), drive mechanism ('737 motor) and force measuring device associated with the clamp so that the force ('737 pressure) on the wire can be measured and converted (adjusted) into changes in bonding parameters ('737, pressure or displacement changes, Claims 7-9).

The Applicant is familiar with the disclosure and claims of the '737 reference. The Applicant respectfully notes that Claim 1 of Farassat '737 recites "a bonding head for a wire bonding machine, comprising guide connected to transducer means for applying pressure ... to a wire guided into contact with a surface ... and adjustment means for automatically adjusting said pressure ... further including a spring means coupled to the transducer holder to urge the transducer means with the guide means toward the surface with a variable force" ('737 Claim 1). The Applicant respectfully notes that the claim limitations and supporting description and illustration in the '737 patent are clearly a **compressive** force, e.g., the compression force applied in forming the wire bonds. Measurement of this compressive force enables the wire bonding machine to automatically adjust preload on the spring means, for example, to accommodate changes in the spring constant of the spring to thereby adjust the force to obtain a predetermined pressure to be applied to the wire (*see*, for example, Claim 5).

The Applicant respectfully notes that the rejected independent Claims 4 and 21 clearly recite measurement of **tensile** force, for example, acting on a bonded connection with the bonding wire that has been produced" (Claim 4). Thus, the Farassat '737 disclosure and claims

are directed to a system measuring compressive force applied to the bonding head prior to and throughout formation of the bond whereas the Applicant's subject application is directed to measuring tensile force on a bonded connection that has already been produced. The Applicant respectfully notes that Farassat '737 provides no suggestion or motivation to perform tensile force measurements as opposed to the disclosed and claimed compressive force measurements as there is no tensile force to be measured in formation of the wire bonds. The Applicant thus strongly believes that the artisan of ordinary skill would not be motivated to explore performing tensile force measurements as in the Applicant's claimed invention. The Applicant respectfully notes that the Examiner provides no motivation in this regard in the Office Action.

Regarding the Zimmerman '860 reference, the Applicant has carefully reviewed the Zimmerman device and method and notes that Zimmerman discloses a system and method to monitor wire feed between wire bond formation steps, for example, to detect an undesired misfeed or breakage of the wire. The Applicant notes that Zimmerman '860 does disclose a wire bonding machine with a transducer 14 adapted to perform a tensile force measurement. However, the structure and operation of the Zimmerman device differs in significant aspects from the claimed invention of the subject application.

More particularly, the Applicant notes that Zimmerman discloses for example, as illustrated in Figure 2 portions (H and I) "...by first actuating the clamp as indicated by the position of clamp 44 in position I, raising the bonder tool slightly and moving the work table slightly toward the right. This motion accomplishes a rearward or leftward motion of the tool and clamped wire, as indicated by arrow 52, and breaks the wire at the second bond B, leaving the newly formed end of the line properly positioned under the tool tip as shown in position (I). If at any time during the sequence of steps described above and illustrated in Figure 2, the wire is not properly positioned, and/or appropriate bonds are not made, wire may become displaced from the lower end of the tool tip 34, resulting in a lost or missing wire. If the wire is lost, the very small motion of the breaking step, moving from position H to position I, will exert little or no tensile force on the wire. If the wire is previously broken inadvertently, there may be no second bond nor any wire extending through wire 36 below the tool tip. If the wire has become dislodged from its feedpath under the tool tip, the very short motion from position H to position I may fail to apply any significant tension to the wire at all. In any event, if the wire is not

positioned properly below the end of the tool tip during the wire breaking step, adequate tensile force cannot be applied and no breaking occurs. The Zimmerman '860 device does thus not in fact measure tensile force but simply measures whether sufficient tensile force has been applied to the tip 34 of the bonder tool to displace it sideways upon relative movement of the work table and bonding tool.

The Applicant further respectfully notes that Zimmerman '860 is not configured to perform a true tensile force measurement but is rather configured as illustrated and described in the description and drawings of Zimmerman of a binary pass/fail or go/no go test simply indicative of proper presence or absence of the wire. More particularly, at Col. 4, line 55, Zimmerman describes "... exertion of a proper working force causes the rectifier 72 to provide a negative going current pulse 76, which is coupled to an amplifier 78 by means of a capacitor 80. The pulse is inverted by amplifier 78, as indicated at pulse 82 and fed to one input of a comparator ... if the input pulse exceeds the reference input to the amplifier, the latter produces a positive going output pulse 90 which is fed to set a bistable circuit comprising a flip flop 982 which in turn provides an output, when set, on line 94, to a suitable visual display or audible alarm device 96 ... if there is a missing wire, there is no variation in force as occurs on breaking of a wire, and concomitantly, no corresponding force is applied to the bonder tool or to the transducer. Therefore, neither the transducer impedance nor its energizing current will vary and no output is provided from the comparison output 84. Flip-flop 92 remains reset and display or alarm 96 will signal the missing wire. Thus, Zimmerman 860 is configured and operates simply to provide a digital or binary set or not set condition indicative of the movement or lack of movement of the bonding tool in response to the wire breaking. Zimmerman '860 does not provide a true tensile force measurement as in the Applicant's claimed invention of the subject application.

Thus, the Applicant notes that no proper motivation or suggestion to combine the Farassat '737 and Zimmerman '860 references has been provided by the Examiner or exists inherently in the teachings of these two references. The Applicant does not believe that a person of ordinary skill would find inherent motivation in considering the problems at hand addressed by the Farassat '757 reference would find motivation to consider the Zimmerman '860 or have reasonable expectation of success upon doing so. The Applicant further notes that even if such a

motivation to combine were to exist, the combination of these two references would fail to render the Applicant's claimed invention of the subject application obvious to an artisan of ordinary skill considering these two references. The Applicant thus respectfully requests that the nonstatutory obviousness-type double-patenting rejection of Claims 4, 6-11, 21, 23, and 27-33 be withdrawn.

The Examiner also rejects Claims 1-4, 8-10, 12-16, 18-21, 23, 29, and 30 under 35 U.S.C. § 102(b) as being anticipated by Price et al. U.S. Patent No. 5,591,920. The Applicant has carefully reviewed the Price reference and notes that Price teaches a wire bond pull tester adapted to perform wire bond pull testing in a destructive or non-destructive manner. Figure 4 of Price illustrates a stress vs. strain diagram obtained for various values of drive current I to a Z drive motor 10 to increase the pull force on the bonding wire. Fixed levels of current are applied in increasing increments to the Z drive motor 10. Elongation of the wire is substantially linear until it reaches a distortion shown at approximately 38 where the elongation for the same increment of current causes a larger increase in strain or elongation. Between points 36 and 39, the linear motor 10 is in a forced mode attempting to apply increasing pull strength to the fine wire 18 and 18a. When the break point 39 is reached, the tool holder would rapidly accelerate in an upward direction unless the total force or current applied to the linear motor is reduced. Thus, anticipating point 39, the linear motor is placed in a position mode where the current applied along the curve shown at 41 is only sufficient to balance the bonding tool holder and transducer at a desired level position (see column 4 lines 37-63). The Applicant respectfully notes that Price teaches that the predetermined current strain relationship is utilized to incrementally apply predetermined forces or to inferentially estimate the force applied as a function of elongation measurements in a destructive or non-destructive pull test. Price does not teach or suggest direct force measurements by a wire bonder to facilitate and process changes of bonding parameters.

The Applicant emphasizes that the evaluated parameter in the Price et al. system is a geometric or dimension parameter of vertical or Z movement/position. Price et al. '920 does disclose providing stepped or incremented currents to the Z drive motor to apply different levels of force to the wire but does not actually measure the force applied as in the Applicant's invention. Thus, Price et al. measures and makes indicated adjustment in the process parameters based on geometric measurements, not on force measurements as in the Applicant's claimed

invention.

The Examiner also rejects Claims 4, 6-10, 21, 23, 27, and 28 under 35 U.S.C. § 102(b) as being anticipated by Zimmerman '860. As previously discussed with respect to the nonstatutory obviousness-type double-patenting rejection, the Applicant strongly believes that Zimmerman fails to show all elements of the Applicant's claimed invention and is thus not anticipated by the Zimmerman reference. The Applicant respectfully requests that the rejection under 35 U.S.C. § 102(b) in view of Zimmerman be withdrawn.

The Examiner also rejects Claims 6, 7, 11, 27, 28, and 31-33 under 35 U.S.C. § 103(a) as being unpatentable over Price '920 in view of Ringler et al. U.S. Patent No. 6,439,448 and Mayer U.S. Patent No. 4,895,028. As previously noted, the Price et al. '920 reference fails to anticipate all of the claimed aspects of the respective base Claims 1, 4, and 21. The Applicant has further reviewed the Ringler '448 and Mayer '028 references and notes the following differences between these and the Applicant's claimed invention. More particularly, the Applicant notes that Ringler '448 teaches an ultrasonic wire bonder assembly including a flexible support having at least one arcuate arm for supporting the bonding tool to allow flexible movement in the Z axis. The Applicant notes, however, that Ringler '448 does not disclose any teaching of force measurement, particularly tensile force acting on a bonded connection to the bonding wire as in the Applicant's claimed invention. Ringler '448 also fails to disclose converting the tensile force measurements into appropriate changes in bonding parameters of a wire bonder.

The Applicant notes that Mayer '028 teaches a pull test device that can be utilized to perform tensile force measurements on the wires of a wire bond, however, the Mayer '028 device is clearly not a wire bonder but rather a separate test apparatus to be employed in conjunction with a wire bonder. The Applicant further notes that even in combination, it is not apparent to the Applicant how the Mayer '028 apparatus could be incorporated with a wire bonder to arrive at the Applicant's claimed invention. More particularly, the Applicant notes that the base claim for example, Claim 21 recites "a wire bonder device comprising a bonding head with an integrated testing arrangement for wire bond connections between a bonding wire and a surface wherein the bonding head comprises: a holding tool to hold a bonding tool; the wire clamp holder to hold a wire clamp for gripping a bonding wire ... a force measuring device associated with the wire clamp holder in order to measure a tensile force acting on a bonded connection to

the bonding wire that has been produced; and a bonding parameter control unit that can convert the tensile force measurements into appropriate changes in bonding parameters." The Applicant believes that one of ordinary skill would not consider the pull test device of Mayer '028 including the substantially horizontal loading arm 1 and rod 3, depending vertically from the other end of the loading arm which end is free to move having at its lower end rod 3, a hook 4 to be a compatible combination with the wire bonder head of Ringler and the diagnostic wire bond pull tester of Price et al. '920. Thus, even should sufficient motivation to combine these references be established, the Applicant strongly believes that any such combination would not be feasible and would still fail to render the Applicant's device as claimed obvious in light of these references.

The Applicant believes that Claims 6, 7, 11, 27, 28, and 31-33 do properly further define the Applicant's claimed invention and are thus also patentable due at least partially to their dependence on the respective base claims.

The Examiner also rejects Claims 11 and 31-33 under 35 U.S.C. § 103(a) as being unpatentable over Zimmerman '860 in view of Ringler et al. '448 and Mayer '028. As previously discussed, the Applicant believes that each of these references individually fail to anticipate the total claimed aspects of the respective base claims. The Applicant similarly believes that the wire pull test arrangement of Mayer would not make a compatible combination with the wire bonder head of Ringler or with the missing wire detector of Zimmerman '860. The Applicant also believes that Claims 11 and 31-33 properly further define the claimed invention and are similarly patentable at least partially due to their dependence on the recited aspects of the respective base claims.

SUMMARY

The Applicant thus believes that the subject application is in a condition ready for allowance and respectfully requests prompt issuance of a notice of allowability. The Applicant believes that this paper fully addresses the objections made by the Examiner in the Office Action, however should there remain any further impediment to the allowance of this application that might be resolved by a telephone conference, the Examiner is respectfully requested to contact the Applicant's undersigned representative at the indicated telephone number.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

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By: _____

James W. Ausley
Registration No. 49,076
Agent of Record
Customer No. 20,995
(951) 781-9231

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